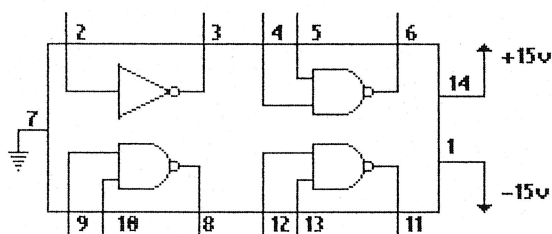


How to build an Rs-232 Interface for the C-64.

by Larry L. Drake

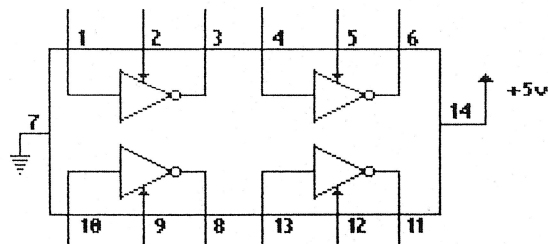
The Rs-232 interface is only one means of having the c-64 talk to the outside world. You can talk to most Rs-232 devices, like other computers via a modem that is external to the c-64 and to printers. It is a electrical interface that has become a computer industry standard. Rs-232 is sometimes referred to as the EIA standard. The Rs-232c standard is a bipolar type interface with voltages that can range from -15vdc to +15vdc with respect to ground. This differs from TTL (Transistor-Transistor-Logic) +5v to ground which is found in your c-64. In Rs-232 a -12vdc is logic 1 or high and +12vdc is a logic 0 or low. In TTL logic a high is +5vdc and a low is 0vdc. The voltage level for Rs-232 can range from -15vdc to -3vdc for a high and +15vdc to 3vdc for a low. -3vdc to +3vdc is undefined and will result in unpredictable translations. Motorola came out with two IC chips to do the TTL to Rs-232 and Rs-232 to TTL translations. They are the MC1488 and MC1489 respectively.

Pinout of MC1488 TTL to RS-232c



Inputs = TTL, Outputs = Rs-232

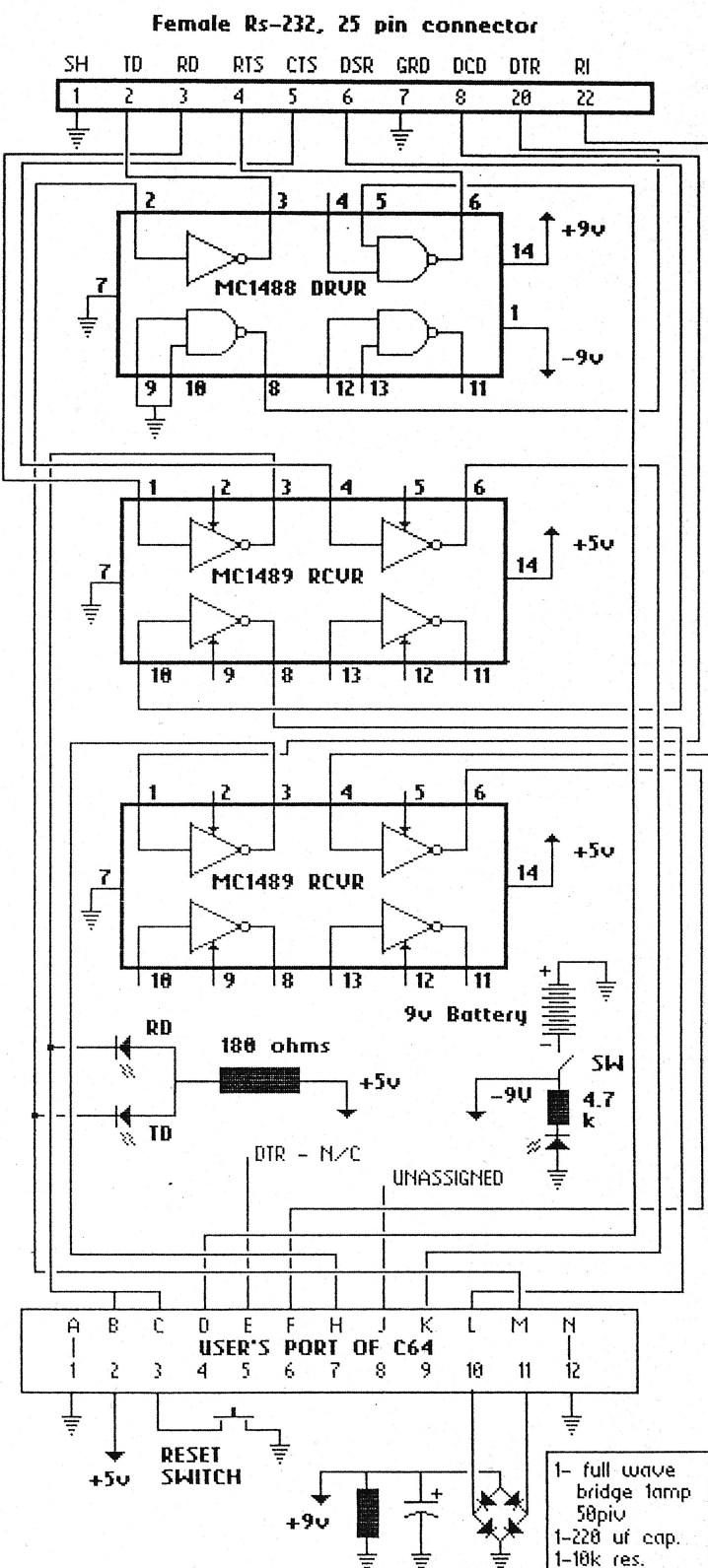
Pinouts for MC1489 Rs-232c to TTL



Inputs = Rs-232, outputs,controls = TTL

For this interface we will use the 9 vac to make a +9vdc and a 9 volt battery for the -9vdc. Nine volts is still within Rs232 specs. We will rectify the nine volts with diodes and capacitors. Plus 5vdc from user port pin 2 will also be used.

Rs-232 signals TD, DTR, and RTS will be output signals and RD, CTS, RI, DCD, and DSR are the input signals we will receive. Use of these signals are defined in the programmer's ref. guide pages 348-359 for C-64.



How to build an rs232 interface continued.

by Larry L. Drake

Some of the problems I ran into in building this device was the way, the c64 develops it's internal voltages made it impossible to create a negative voltage. The cheapest way to create this negative voltage was to use a 9 volt battery. Most interfaces I have seen are using a dc to dc converter or a transformer to help generate the minus voltage. The second problem was to get the interface to work with some terminal package and a modem or null modem. Everything worked fine with the null modem, but with a real modem the DTR was not set up right. I ended up ensuring that DTR would come up as soon as the interface was powered up. Which in the real world is what most computers do. DTR is also used to tell a modem when to hang up or when it is OK to answer a incoming call. As is right now your can't drop DTR to the modem to cause it to hangup. To do so connect pin E of user port to pins 9 and 10 of MC1488 chip and remove ground. Also some programs may have to be modified to set DTR to zero so the modem will see a +9v on pin 20 of rs232 connector. Setting DTR to a one momentary will cause a modem to hang up. This is what some computers do upon loss of carrier or DCD.

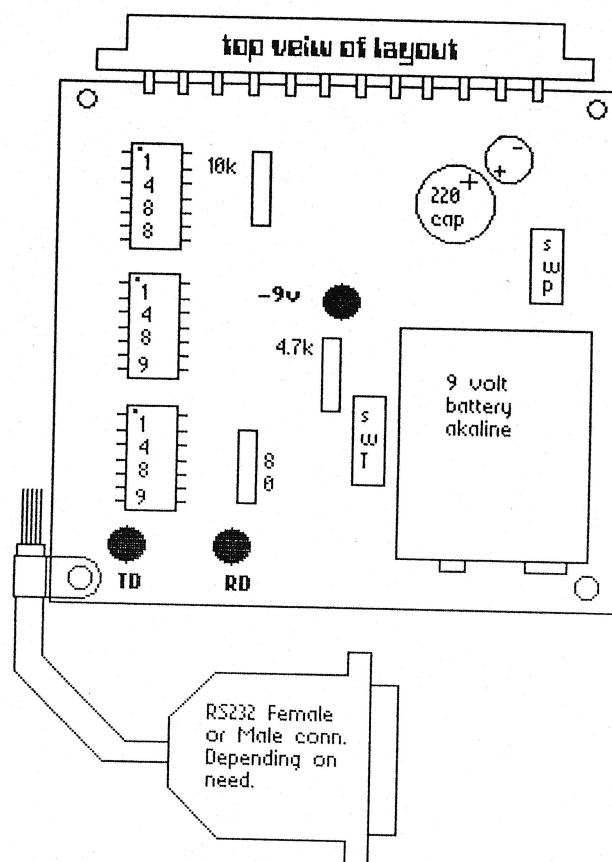
If there are any questions about this interface feel free to call. My home phone is 895-1583. Most of the parts I used for this interface came from Radio Shack or from Scott's Electronics near 48th and F street. Below is a list of materials. Cost is about \$28.00

List of materials:

1 50-24a-30 connector	\$3.98
must get from Scott's.	
1 9v battery alkaline	\$2.50
1 9v battery snap	5/ .99
1 220 uf electrolyc cap.	.89
1 10k ohm resistor	.25
1 4.7k ohm resistor	.25
1 180 ohm resistor	.25
1 MC1488 RS232 DRVR	\$1.09
2 MC1489 RS232 RCVR	\$1.09
1 RS232 25 pin female conn.	\$1.99
1 Hood kit for RS232 conn.	\$1.09
1 6" 12 wire cable	1ft .25
2 pc boards 276-168	ea. \$1.95
1 full wave bridge 276-1161	\$1.09
3 leds 276-841	2/ .69
1 pushbutton switch	\$1.49
1 toggle switch pc mount	\$1.49
1 misc hardware 4 - screws & nuts, cable clamp, elect. tape and spacers to separate the 2 pc boards.	\$3.00

note: I have found Scott's electronics to be cheaper than Radio Shack for parts. You will have to get the c64 connector from Scott's and the pc board from Radio Shack. You could also use a longer 12 wire cable and a male RS232 connector to go directly to a external modem. This way a second cable is not needed.

component layout of pc board with notes:



more notes:

The pc board is soldered to pins b-m on connector. every other pin is soldered to two pads. The second pc can be left off if you use elect. tape to insulate solder side of board.

Toggle switch is used to turn off 9v battery when not in use. I could make this interface for you for \$25.00 but I'm not in the manufacturing business. I'm just a Hobbyist. I can make the null modem cable for \$10-\$15.00.

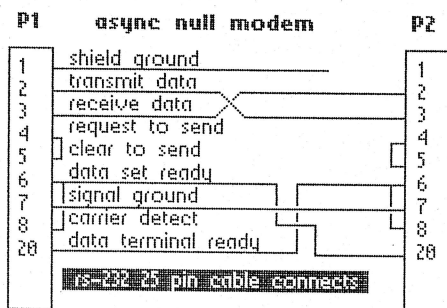
Please note that this project is not for the beginner. Some knowledge of electronic is helpful and some skill with a soldering iron also can't hurt. It took me about 4 hours to build this project once I had all the materials. I also forgot to mention that some spare wire is needed. Two of these interfaces are now in use within the club. I have also donated a c64 to c64 null modem cable to the club. Happy interfacing.
Larry L. Drake

Using a Null Modem

by Larry L. Drake

In doing this article, I decided to use geopaint to show how a null modem works with text and drawing. My background is strong in electronics and computers for the last 16 years.

What is a null modem you say? It is a device that can connect two computers together between short distances and make them think they're connected to a modem. This can be done within a computer cable. I will show in a wiring diagram, how this is done and then explain it.



notes:

1. shield ground is normally connected to any one end if cable is shielded.
2. transmit data comes in as receive data on opposite ends of connectors.
3. request to send and clear to send is jumpered at each end.
4. data terminal ready is used to tell computer on other end that it and the line is ready.
5. one thing to remember is not all computers use all control lines, you need a minimum of three, transmit & receive data and signal ground.
6. pins 20, 6 & 8 could be jumpered at each end if you want to run a 3 wire cable.

I am using the three wire operation with TRI-4 connectors from scott's electronics for about \$3.98 each, part #50-24A-30, 251-12-30-160 is printed on it.

WARNING: this connector fits on the user port and can be turned upside down. If this is done you will damage the other computer by putting 9vac to the signal pins. reference the programmer ref. guide for more details of pin layout.

The following is an RS-232 pin to user port pin reference.

RS-232	user port
1	A ground
2	M transmit
3	C receive
4	D RTS
5	K CTS
6	L DSR
7	N ground
8	H CD
20	E DTR

WARNING: you can not connect an rs-232 port from another computer to this port without getting a RS-232 interface to connect to the user port. the logic levels are not compatible. The user port is at TTL logic level and can be connected to another c64 user port in this matter. You can also connect RS-232 to RS-232 using the Rs-232 pins.

The Null Modem is a low cost means for two computers to talk to each other. You can talk to each other in terminal mode or pass disk files from one type computer to another. This is great for data files and source ascii files. Passing program files between two different computers normally don't pay off unless one of the computers is set up as a file server and doesn't plan to run them.

I have built a c64 to c64 null modem for our club to use for terminal & communication demos. If some else wants to make a null modem for themself, I would be glad to help. My home phone is 895-1583, after 6pm and on weekends.

Larry L. Drake

FOR SALE:

Commodore Plus-4 Computer

Computer is 3 months old and has built in software. \$55.00 or Best Offer. It does work well with 1541 disk drive.

895-1583 after 6pm.